

REMARKS

Claims 19 and 21-27 are amended. No claims have been canceled or added. Accordingly, after entry of this amendment, claims 1-27 will remain pending.

Applicants are pleased to note the Examiner indicated that claims 7-18 are allowable if rewritten in independent form.

Reconsideration and allowance of this application are respectfully requested.

Claims 21-26 were rejected under 35 U.S.C. § 112, second paragraph.

The Examiner states that claims 21 and 22 are indefinite because “said valve control means” lacks antecedent basis, claims 23 and 24 are indefinite because “said injection valve” lacks antecedent basis, claim 25 is indefinite because “each said gas injection nozzles” lack antecedent basis and claim 26 is indefinite because “said gas injection plate” lacks antecedent basis. To address these rejections, Applicants have amended claims 21-26 to depend from claim 27 which recites “a plurality of valve controllers, a plurality of gas injection valves, a plurality of gas injection nozzles and a gas injection plate,” among other features. Accordingly, Applicants respectfully submit that claims 21-26 are in full compliance with § 112, second paragraph and respectfully request that the rejection of claims 21-26 under § 112, second paragraph be withdrawn.

Claims 1-4 were rejected under 35 U.S.C. § 102(e) as being anticipated by Winniczek et al. (U.S. Pat. No. 6,093,332). Applicants respectfully traverse this rejection for at least the following reasons.

Claim 1 recites, *inter-alia*, “creating a plasma within the reactor chamber by establishing an RF electromagnetic field within the chamber and allowing the field to interact with the process gas; and causing the electromagnetic field to have an energy level which varies cyclically between at least two values each sufficient to maintain the plasma, such that each energy level value is associated with performance of a respectively different treatment process on the substrate.” By causing the RF electromagnetic field which creates the plasma to have an energy level which varies cyclically between two values, each sufficient to maintain the plasma, it is possible, for example, to enhance the performance of a plasma treatment process on the substrate.

Winniczek et al. merely discloses that a plasma is formed by supplying an RF power generated by RF generator 305 to coil 304 (electrode 304). Winniczek et al. discusses that a pulsed RF bias power generated by RF generator 314 is supplied to chuck electrode 312 (see Figure 3 and col. 4 in Winniczek et al.). The pulsed RF bias power generated by RF generator 314 is not used to form the plasma but merely to alter the energy of ions in the plasma (see col. 5, lines 32-34 in Winniczek et al.). The RF bias power is pulsed between a high power level and a low power level in order to reduce mask erosion during etching (see col. 4, lines 48-51 in Winniczek et al.). In other words, the RF bias power is merely used to bias the chuck electrode in order to control mask erosion and not to create the plasma. For example, if the bias RF power supplied to the chuck electrode is decreased, polymer deposition tends to be increased and less mask erosion occurs (see col. 5, lines 41-46 in Winniczek et al.).

As is apparent, Winniczek et al. does not teach each and every limitation as recited by the method recited by claim 1. Accordingly, Winniczek et al. cannot be relied upon to anticipate claim 1. Therefore, Applicants respectfully submit that claim 1, and claims 2-4 which depend from claim 1, are patentable. Thus, Applicants respectfully request that the rejection of claims 1-4 under § 102(e) be withdrawn.

Claims 1-6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Winniczek et al. (U.S. Pat. No. 6,093,332) in view of Heinecke et al. (U.S. Patent No. 4,935,661). Applicants respectfully traverse this rejection for at least the following reasons.

As stated above, Winniczek et al. fails to disclose, teach or suggest the subject matter recited in claim 1. In response to Applicants' arguments filed December 5, 2003, the Examiner concedes that Heinecke et al. does not maintain the plasma. Furthermore, Heinecke et al. teaches a plasma processing method that employs an RF field to create a plasma. The RF field is turned on and off. When the RF field of Heinecke et al. is on, the field has a single energy level (e.g., 100w/cc, see Column 2, Line 10). There is no suggestion in Heinecke et al. to vary the amplitude of the electromagnetic field, or correspondingly, the energy level of the field, during the time that the field is turned on. As indicated at Column 2, Lines 44-46, the RF field is left on only for a short period of time in which no gas exchange occurs during the RF pulse. The RF field is turned off for a much higher percentage of the time than it is turned on. When the RF field is turned off, the plasma extinguishes very quickly. Thus, for the time that the field is turned on, there is no indication in Heinecke et al. that the energy level varies at all, even though the electromagnetic field is an RF

electromagnetic field. Furthermore, the field off state cannot represent one of the energy levels referred to in Claim 1 since Claim 1 requires that each energy level be sufficient to maintain the plasma. Consequently, Heinecke et al. also fails to overcome the deficiencies noted above in Winniczek et al.

Therefore, Applicants respectfully submit that neither Winniczek et al. nor Heinecke et al., alone or in combination, disclose, teach or suggest, the subject matter recited in claim 1. Therefore, Applicants respectfully submit that claim 1, and claims 2-6 which depend from claim 1, are patentable over the references cited. Thus, Applicants respectfully request that the rejection of claims 1-6 under § 103(a) be withdrawn.

Claims 19-21, 23, 24, 26 and 27 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Winniczek et al. (U.S. Pat. No. 6,093,332) in view of Mahawili et al. (U.S. Patent No. 4,993,358). Applicants respectfully traverse this rejection for at least the following reasons.

Claim 19 recites, *inter-alia*, “an RF power supply configured to create an RF electromagnetic field in the plasma region, which field interacts with the process gas to create a plasma, the field having an energy level which varies cyclically between at least two values each sufficient to maintain the plasma.” Among other reasons, by providing an RF electromagnetic field having an energy level which varies cyclically between at least two values each sufficient to maintain the plasma, the performance of a plasma treatment process on a substrate can be enhanced.

As stated above with respect to claim 1, Winniczek et al. merely discloses that a pulsed RF bias power generated by RF generator 314 is supplied to chuck electrode 312 (see Figure 3 and col. 4 in Winniczek et al.). The pulsed RF bias power generated by RF generator 314 is not used to form the plasma but merely to alter the energy of ions in the plasma (see col. 5, lines 32-34 in Winniczek et al.). Consequently, Winniczek et al. does not disclose, teach or suggest an RF power supply configured to create an RF electromagnetic field in the plasma region, which field interacts with the process gas to create a plasma, the field having an energy level which varies cyclically between at least two values each sufficient to maintain the plasma, as recited in claim 19.

Mahawili et al. fails to overcome the deficiencies noted above of Winniczek et al. Mahawili merely discusses a chemical vapor deposition reactor in which angles of injection of reactant gas is selected. Mahawili et al. does not even disclose, teach or suggest forming a plasma by using RF energy. Consequently, neither Winniczek et al. nor Mahawili et al.,

alone or in combination, disclose, teach or suggest the subject matter recited in claim 19. Therefore, Applicants respectfully submit that claim 19, and claims 20-21, 23, 24, 26 and 27 which depend directly or indirectly from claim 19, are patentable. Thus, Applicants respectfully request that the rejection of claims 19-21, 23, 24, 26 and 27 under § 103(a) be withdrawn.

Claim 22 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Winniczek et al. (U.S. Pat. No. 6,093,332) in view of Mahawili et al. (U.S. Patent No. 4,993,358) and further in view of Bates et al., "Fast gas injection system for plasma physics," Rev. Sci. Instrum., Vol. 55, No. 6, June 1984. Applicants respectfully traverse this rejection for at least the following reasons.

Claim 22 depends indirectly from claim 19. Therefore, for at least the reasons presented above with respect to claim 19, Applicants respectfully submit that claim 22 is patentable over the combination of Winniczek et al. and Mahawili et al.

Bates et al. fails to overcome the deficiencies of the combination of Winniczek et al. and Mahawili et al. noted above. Bates et al. merely discusses a gas injection system that uses a piezoelectric valve. Bates et al. does not disclose, teach or suggest forming a plasma using RF energy.

Therefore, none of Winniczek et al., Mahawili et al. and Bates et al., alone or in combination, disclose, teach or suggest the subject matter recited in claim 22. Thus, Applicants respectfully request that the rejection of claim 22 under § 103(a) be withdrawn.

Claim 25 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Winniczek et al. (U.S. Pat. No. 6,093,332) in view of Mahawili et al. (U.S. Patent No. 4,993,358) and further in view of Eres et al. (U.S. Pat. 5,164,040). Applicants respectfully traverse this rejection for at least the following reasons.

Claim 25 depends indirectly from claim 19. Therefore, for at least the reasons presented above with respect to claim 19, Applicants respectfully submit that claim 25 is patentable over the combination of Winniczek et al. and Mahawili et al.

Eres et al. fails to overcome the deficiencies of the combination of Winniczek et al. and Mahawili et al. noted above. Eres et al. merely discusses injecting a gaseous source of material into a chamber in the form of a pulsed supersonic jet. Eres et al. does not disclose, teach or suggest forming a plasma using RF energy.

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Therefore, none of Winniczek et al., Mahawili et al. and Eres et al., alone or in combination, disclose, teach or suggest the subject matter recited in claim 25. Thus, Applicants respectfully request that the rejection of claim 25 under § 103(a) be withdrawn.

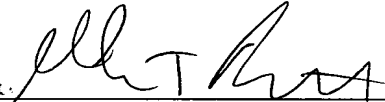
CONCLUSION

In view of the foregoing, the claims are now in form for allowance, and such action is hereby solicited. If any point remains in issue which the Examiner feels may be best resolved through a personal or telephone interview, he is kindly requested to contact the undersigned at the telephone number listed below.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully Submitted,

PILLSBURY WINTHROP LLP

By:  REG NO
Jeffrey D. Karceski 20205
Reg. No.: 35,914
Tel. No.: (703) 905-2110
Fax No.: (703) 905-2500

JDK/KG

00909
P.O. Box 10500
McLean, VA 22102
(703) 905-2000